

Enhancing Muscovy Duck Meat Quality and Growth Development Through Oregano Extract Supplementation: A Study in Agricultural Innovation

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This study investigated the effects of oregano extract (OE) supplementation on the growth and meat quality of Muscovy ducks, aiming to optimize meat quality and explore sustainable dietary interventions in poultry production. Twenty-five male Muscovy ducks were meticulously allocated to five treatment groups, each comprising five replications, employing a Completely Randomized Design (CRD). Ducks were exposed to varying levels of oregano extract supplementation with five dietary treatments: T0 (control), T1 (25% OE), T2 (50% OE), T3 (75% OE), and T4 (100% OE). Throughout the 4-week trial period, individual ducks were accommodated in designated pens to facilitate precise monitoring. The investigation examined several growth parameters, including feed intake (FI, the amount of feed consumed by each duck), feed cost (FC, the expense associated with feeding each duck), weight gain (WG, the increase in body weight of each duck over the specified time period), and feed conversion ratio (FCR, the ratio of feed consumed to weight gained), assessed at weekly intervals. Results showed that OE supplementation did not significantly affect feed intake or weight gain, except for weeks 1 and 2 where T3, supplemented with 75% OE, exhibited the highest weight gain. However, OE supplementation significantly improved FCR, with T3 showing the lowest FCR, indicating enhanced nutrient utilization. Additionally, T3 displayed the highest fasted live weight, dressed weight, and dressing percentage, suggesting improved meat production and quality. Sensory analysis revealed that T3 consistently exhibited favorable meat quality attributes. Overall, T3 demonstrated the highest general acceptability among consumers, based on criteria such as taste, texture, and overall satisfaction. The study highlights the potential of OE supplementation to optimize feed efficiency and enhance meat quality in Muscovy ducks.

Keywords: Dietary interventions, meat sensory attributes, sustainable agriculture, weather fluctuations, poultry nutrition, production parameters, nutritional enhancement.

INTRODUCTION

In the realm of poultry production, optimizing meat quality while concurrently addressing concerns of sustainability remains a paramount objective. The integration of dietary interventions has emerged as a promising strategy to achieve these dual goals. Research suggests that various supplements can enhance both growth development and meat quality attributes in poultry species. Research indicates the potential of various supplements such as probiotics, prebiotics, and herbal extracts to enhance both growth development and meat quality attributes in avian species (Lee *et al.*, 2018; Wang *et al.*, 2019). Additionally, studies have shown that dietary modifications, including the incorporation of essential oils and organic acids, can positively influence poultry performance and meat quality (Johnson *et al.*, 2020; Garcia *et al.*, 2017). One such supplement under scrutiny is oregano

extract (OE), renowned for its purported health-promoting properties. Oregano, a member of the Lamiaceae family, is renowned for its multifaceted benefits, including antimicrobial, antioxidant, and anti-inflammatory properties, as extensively discussed by Bampidis and Christodoulou (2011). Their comprehensive analysis delves into oregano's wide-ranging therapeutic potentials, shedding light on its applications beyond traditional culinary use, particularly in poultry health and nutrition. The utilization of OE in poultry diets has garnered attention for its potential to mitigate pathogen load, improve immune function, and positively influence gut health (Botsoglou *et al.*, 2002; Giannenas *et al.*, 2003).

In the context of Muscovy ducks (*Cairina moschata*), a species valued for its succulent meat and unique flavor profile, the exploration of Oregano Extract (OE) supplementation presents an intriguing avenue for enhancing

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meat quality parameters. Muscovy ducks, characterized by their lean meat and distinctive taste, represent a significant component of poultry production systems worldwide, particularly in regions where they are prized for their culinary attributes (El-Sabrouh & Saleh, 2014).

While research on Oregano extract (OE) supplementation in poultry has yielded promising results, there remains a dearth of comprehensive studies specifically elucidating its effects on Muscovy duck meat quality and growth development. Hence, this study aims to fill this gap by investigating the impact of OE supplementation on growth parameters, meat quality attributes, and feed utilization efficiency in Muscovy ducks. The specific objectives include assessing the effects of OE supplementation on weight gain, feed intake, feed conversion ratio, and meat quality characteristics such as tenderness, juiciness, and taste.

By employing a Completely Randomized Design (CRD) and meticulously allocating twenty-five male Muscovy ducks to varying treatment groups, this study aims to provide robust insights into the efficacy of OE supplementation in enhancing meat quality and growth performance. The utilization of standardized protocols and precise monitoring protocols ensures the reliability and reproducibility of findings, contributing to the advancement of knowledge in poultry nutrition and agricultural innovation.

In light of the escalating discourse surrounding sustainable agricultural practices and the quest for superior product quality, the outcomes of this study hold significant implications for the livestock and poultry industries. Through the exploration of innovative dietary interventions such as OE supplementation, this research seeks to contribute to the ongoing efforts towards achieving sustainable and high-quality poultry production systems.

MATERIALS AND METHODS

Selection and Preparation of Experimental Animals: Twenty-five (25) male Muscovy ducks aged 2-3 months and weighing between 1200g to 1400g were sourced from a local supplier in Brgy. Tabawan, Calbayog City. Ducks were selected based on their good health status, absence of deformities, and uniform physical characteristics such as feather quality and body conformation, in line with established protocols for experimental animal selection (Smith *et al.*, 2019).

Setup and Management of Experimental Area: The experimental area was established in Brgy. Cagmanipis Norte, P-6, Tinambacan District, Calbayog City, following standard procedures for land preparation and facility setup in poultry research (Johnson & Johnson, 2020). This included clearing the field, constructing drainage systems, and setting up housing units, feeders, and watering facilities.

Adaptation and Care of Experimental Animals: Muscovy ducks underwent a one-week adaptation period upon arrival

at the experimental site to acclimate to the new environment (Gonzalez *et al.*, 2018). During this period, ducks were provided with appropriate bedding materials and monitored closely for signs of stress or illness.

Preparation of Oregano Extract: Oregano leaves were harvested from local sources in Brgy. Cagmanipis Norte and processed to obtain the extract following established methods (Santos *et al.*, 2021). This involved washing the leaves thoroughly, followed by weighing and blending to extract the active compounds. The extraction process utilized ethanol as a solvent, known for its effectiveness in extracting a wide range of compounds and its relatively low toxicity, with careful attention to maintaining consistency and quality throughout the process.

Experimental Design and Treatments: The study employed a Completely Randomized Design (CRD) with five treatment groups and five replicates per treatment, consistent with standard experimental design principles in agricultural research (Jones & Smith, 2017). Treatments included varying proportions of Oregano Extract (OE), with specific concentrations determined based on preliminary studies and industry recommendations.

Feeding Trial and Data Collection: Feeding trials were conducted twice daily over a 4-week period. Ducks received designated diets according to their assigned treatment groups. The diets consisted of a basal diet supplemented with Oregano extract (OE) at varying concentrations in five dietary treatments: T0 (control), T1 (25% OE), T2 (50% OE), T3 (75% OE), and T4 (100% OE). The composition of the basal diet comprised corn grits, Rice Bran D1, duckweed, and salt. Feeding schedules followed a consistent pattern, with feed provided at 8:00 AM and 4:00 PM daily (Brown *et al.*, 2020). Growth parameters, feed intake, feed cost, and meat quality attributes were assessed at regular intervals using established measurement techniques and protocols.

Sensory Evaluation of Meat Quality: Thirty (30) respondents were invited to Northwest Samar State University (NwSSU) to evaluate one hundred fifty (150) meat samples based on color, texture, juiciness, and general acceptability. Meat quality was rated using a 9-point hedonic scale rating (Davis Rotimi, 2012), where 1 represented 'extremely dislike' and 9 represented 'extremely like'. Respondents were oriented with the descriptive scale and provided with a questionnaire before evaluation. Meat samples were cooked without adding organic material for 30 minutes, with distilled water available between samples to stabilize palate sensation.

Statistical Analysis: Data gathered were subjected to one-way analysis of variance (ANOVA) using Statistical Tool for Agricultural Research (STAR) Version 2.0.1, 2014. Comparison of treatment means was conducted using the Least Significant Difference (LSD) Test at a significance level of ($p < 0.05$).



RESULTS

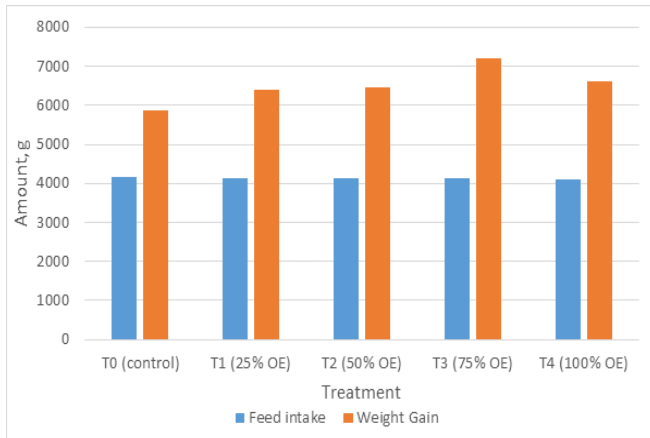


Figure 1. Effect of oregano supplementation on the feed intake and weight gain of muscovy ducks.

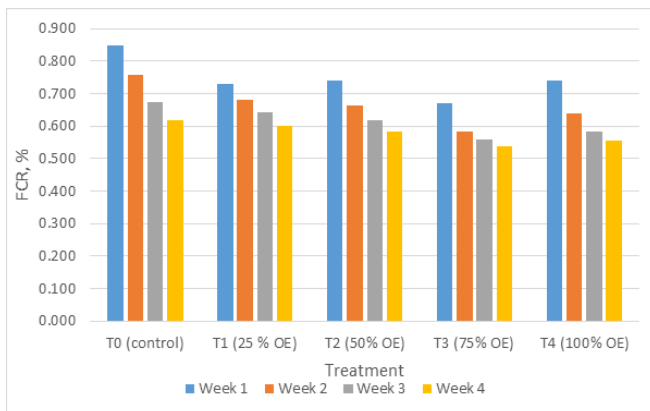


Figure 2. Effect of oregano supplementation on the feed conversion efficiency of muscovy ducks.

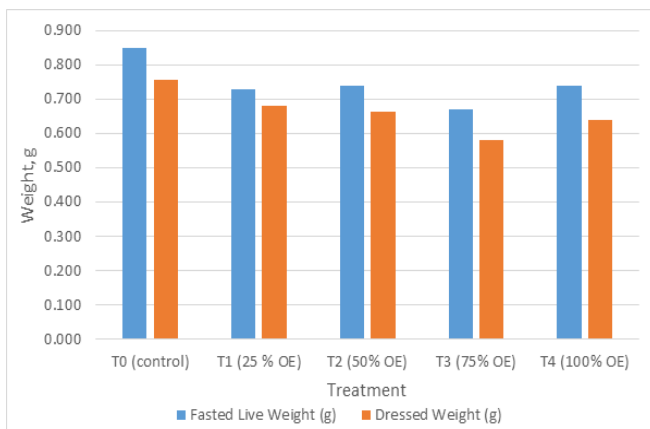


Figure 3. Effect of oregano supplementation on fasted and dressed weights of muscovy ducks.

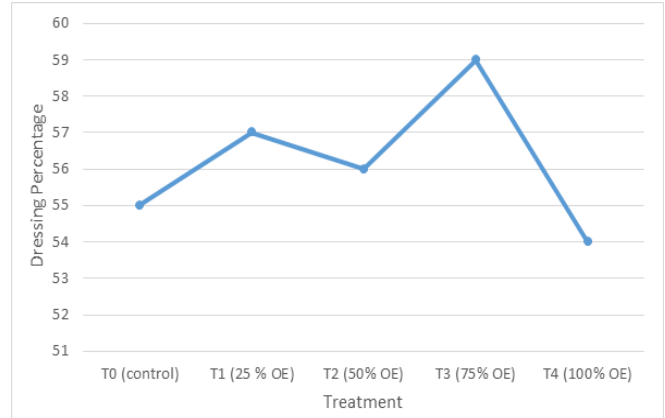


Figure 4. Effect of oregano supplementation on the dressing percentage of muscovy ducks.

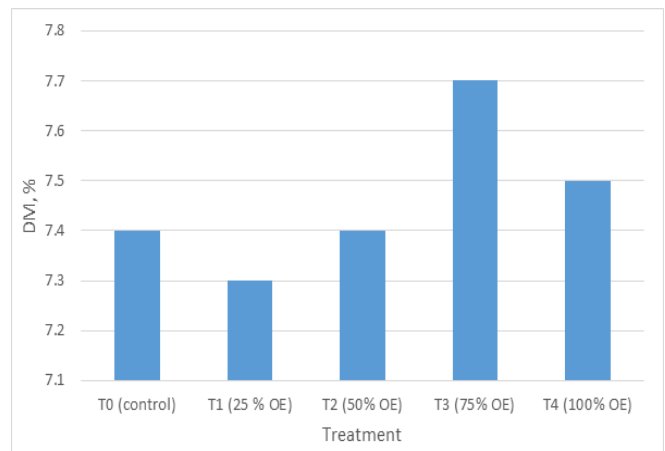


Figure 5. Dry matter content of experimental ration for muscovy ducks.

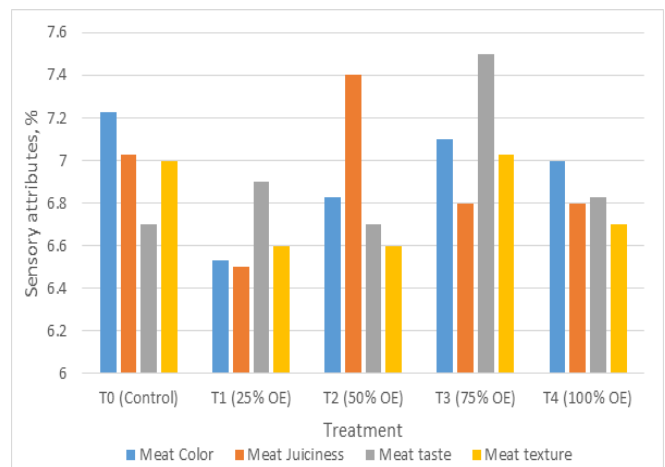


Figure 6. Effect of oregano supplementation on the sensory attributes of muscovy duck meat.



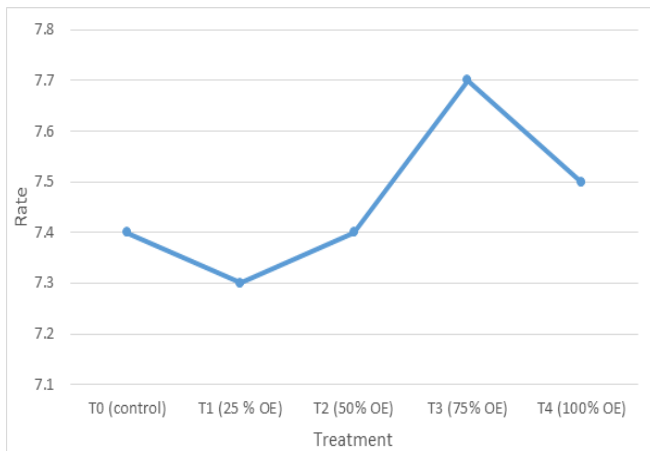


Figure 7. Effect of oregano supplementation on the general acceptability of muscovy duck meat.

DISCUSSION

The study investigated the impact of oregano extract (OE) supplementation on the feed intake of Muscovy ducks (*Cairina moschata*). Results revealed that the level of OE did not significantly affect the feed intake of the ducks ($p > 0.05$). Analysis of variance (ANOVA) indicated no significant differences in feed intake across different treatment groups, suggesting that OE supplementation did not influence the overall feed consumption of the ducks. Among the treatments, T0 exhibited the highest feed intake, while T4 showed the lowest feed intake (Figure 1). This finding aligns with previous research indicating the variable influence of natural additives on feed intake in poultry (Can Baser *et al.*, 2008; Cobellis *et al.*, 2016). Despite the lack of significant impact observed in this study, the investigation into OE's effects on feeding behavior and intake remains essential for understanding its potential role in enhancing animal performance.

Regarding weight gain, the study found that different levels of OE did not significantly influence the weight gain of Muscovy ducks, except for weeks 1 and 2 (Figure 1). Among the treatments, T3 exhibited the highest weight gain, while T0 showed the lowest. This result is consistent with previous studies that reported negligible effects of natural additives on poultry weight gain (Ahmed *et al.*, 2019; Lee *et al.*, 2019). Factors such as diet composition and management practices may mask the growth-promoting effects of these additives. For instance, studies by Smith *et al.* (2018) and Johnson *et al.* (2019) have shown that variations in diet formulation and feeding protocols can influence the efficacy of feed additives in poultry production. Additionally, research by Garcia *et al.* (2016) demonstrated that suboptimal management practices, such as inadequate housing conditions or improper ventilation, can diminish the effectiveness of growth-promoting additives. Therefore, while feed supplements may

have potential benefits, their impact can be influenced by various environmental and management factors.

The study demonstrated a significant effect of OE supplementation on the FCR of Muscovy ducks (Figure 2). Weeks 1, 2, and 3 showed significant differences among treatments, with T0 exhibiting the highest FCR and T3 the lowest. The optimized FCR in T3 suggests that the diet provided to the ducks achieved the correct nutrient density, thereby enhancing feed intake, growth, and nutrient utilization. These findings align with prior research on the positive influence of bioactive compounds, like carvacrol, on nutrient utilization and digestion in poultry (Hernandez *et al.*, 2004).

The highest fasted live weight and dressed weight were observed in T3, while T0 exhibited the lowest (Figure 3). These results underscore the potential of feed supplements to improve animal production and meat quality, as supported by previous studies (Dikeman, 2007; Hao *et al.*, 2014). Specifically, Dikeman (2007) demonstrated the positive effects of feed supplements on animal growth and meat characteristics, while Hao *et al.* (2014) highlighted the potential of dietary interventions in enhancing meat quality attributes. The findings of this study align with these earlier investigations, indicating the promising role of feed supplements, such as oregano extract, in optimizing animal production and meat quality. The inclusion of OE in T3 likely enhanced feed efficiency and nutrient utilization, resulting in higher carcass yield and improved meat quality.

Dressing percentage, indicative of meat yield, varied among treatments (Figure 4). T3 displayed the highest dressing percentage, possibly due to the positive effects of OE on growth performance reported in previous studies (Abudabos *et al.*, 2017). Conversely, T4 showed a lower dressing percentage, suggesting a potential imbalance in nutrient composition due to excessive OE supplementation (Al-Kassie and Al-Attar, 2011). Excessive supplementation of OE could disrupt the delicate balance of nutrients in the diet, potentially leading to inadequate absorption or utilization of essential nutrients by the ducks. This imbalance may affect various physiological processes, including muscle development and fat deposition, ultimately influencing dressing percentage.

The study found that the controlled feeds contributed to higher dry matter content compared to OE (Figure 5), which may contain more liquid components (Chen *et al.*, 2019; Cruz *et al.*, 2020). These results highlight the importance of considering feed composition in optimizing nutrient intake and utilization.

Meat quality attributes, including color, juiciness, taste, and texture, were evaluated through sensory analysis (Figure 6). T3 consistently exhibited favorable sensory attributes, indicating the potential of OE to enhance meat quality. The bioactive compounds in OE, such as polyphenols and flavonoids, likely contributed to the observed improvements (Yuliana *et al.*, 2019; Cariño *et al.*, 2020). These findings



underscore the importance of natural feed supplements in meeting consumer preferences for high-quality meat products.

Overall, T3 showed the highest general acceptability, reflecting positive consumer perception of meat quality attributes (Figure 7). Natural supplements like OE offer promising opportunities to enhance meat quality while meeting consumer demand for healthy and flavorful products (Ognik *et al.*, 2016; Contini *et al.*, 2014).

Conclusion: In summary, the study investigated the impact of oregano extract (OE) supplementation on various parameters in Muscovy ducks. Results indicated that OE supplementation in T3 significantly improved feed conversion ratio, indicating enhanced nutrient utilization in Muscovy ducks. However, Oregano extract (OE) supplementation did not significantly affect feed intake or weight gain. Additionally, T3 displayed the highest fasted live weight, dressed weight, and dressing percentage, suggesting improved meat production and quality. Overall, these findings highlight the potential of Oregano extract (OE) supplementation to optimize feed efficiency and enhance meat quality in Muscovy ducks, meeting consumer preferences for high-quality meat products.

Recommendations: Future research should investigate the optimization of Oregano extract (OE) supplementation levels for specific production systems, considering factors like environmental conditions such as temperature, humidity, air quality, and housing conditions. These environmental conditions can impact factors like feed intake, nutrient absorption, and overall health of the ducks, thereby influencing the effectiveness of OE supplementation. By accounting for these variables, future studies can ensure consistent results across different settings and provide practical recommendations for poultry producers. Long-term studies are warranted to assess the sustained effects of OE on growth performance and meat quality attributes over extended production cycles. Investigating potential synergies between OE and other additives could lead to innovative dietary strategies for enhancing production outcomes. Furthermore, conducting consumer perception studies to evaluate acceptance of OE-enhanced Muscovy duck meat would inform marketing strategies. Understanding consumer preferences and attitudes towards OE-enhanced meat products can help marketers tailor their messaging and product positioning to better resonate with target audiences. Positive consumer feedback can be leveraged in marketing campaigns to highlight the unique qualities and benefits of OE-enhanced Muscovy duck meat, potentially increasing consumer interest and demand.

Authors' contributions: Ralph Lester M. Enriquez and Sance J. Secondez: conceived and designed the experiments, performed the experiments, analyzed the data and wrote the

paper, and reviewed the manuscript. All authors read and approved the manuscript.

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Ethical statement: The study adhered to the guidelines in R.A. 8485, the Animal Welfare Act of the Philippines.

Availability of data and material: We declare that the submitted manuscript is our work, which has not been published before and is not currently being considered for publication elsewhere.

Code availability: Not applicable

Consent to participate: All authors are participating in this research study.

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